proceq

PUNDIT® PL-200PE
OPERATING INSTRUCTIONS

60 Years of Innovation

Made in Switzerland

Scope of Delivery

A Pundit Touchscreen

B Battery

C Pundit Pulse Echo Transducer*

D Pundit Pulse Echo Cable*

E Pundit Pulse Echo Contact Tester*

F Battery Charger

G USB Cable

H DVD with Software

I Documentation*

J Carrying Strap

K Calibrated Tape*

*Part of the “Pundit Pulse Echo Transducer” package (Part No. 327 40 130)

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Overview Pundit PL-200PE

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1. Safety and Liability

1.1 General Information

This manual contains important information on the safety, use and maintenance of the Pundit PL-200PE. Read through the manual carefully before the first use of the instrument. Keep the manual in a safe place for future reference.

1.2 Liability

Our “General Terms and Conditions of Sales and Delivery” apply in all cases. Warranty and liability claims arising from personal injury and damage to property cannot be upheld if they are due to one or more of the following causes:

- Failure to use the instrument in accordance with its designated use as described in this manual.
- Incorrect performance check for operation and maintenance of the instrument and its components.
- Failure to adhere to the sections of the manual dealing with the performance check, operation and maintenance of the instrument and its components.
- Unauthorised modifications to the instrument and its components.
- Serious damage resulting from the effects of foreign bodies, accidents, vandalism and force majeure

All information contained in this documentation is presented in good faith and believed to be correct. Proceq SA makes no warranties and excludes all liability as to the completeness and/or accuracy of the information.

1.3 Safety Instructions

The equipment is not allowed to be operated by children or anyone under the influence of alcohol, drugs or pharmaceutical preparations. Anyone who is not familiar with this manual must be supervised when using the equipment.

- Carry out the stipulated maintenance properly and at the correct time.
- Following completion of the maintenance tasks, perform a functional check.

1.4 Correct Usage

- The instrument is only to be used for its designated purpose as describe herein.
- Replace faulty components only with original replacement parts from Proceq.
- Accessories should only be installed or connected to the instrument if they are expressly authorized by Proceq. If other accessories are installed or connected to the instrument then Proceq will accept no liability and the product guarantee is forfeit.

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2. Technical Specifications

	Pundit PL-200	Pundit PL-200PE
Range	0.1 – 7930 µs	
Resolution	0.1 µs (< 793 µs), 1 µs (> 793 µs)	
Display	7” colour display 800x480 pixels	
Pulse Voltage UPV	100 – 450 Vpp	
UPE	–	100 – 400 Vpp
Bandwidth	20 – 500 kHz	
Receiver Gain	1x – 10’000x (0 – 80dB) [11 steps]	
Memory	Internal 8 GB Flash memory	
Regional Settings	Metric and imperial units and multi-language supported	
Battery	Lithium Polymer, 3.6 V, 14.0 Ah	
Battery Lifetime	> 8h (in standard operating mode)	
Operating Temperature	0°C – 30°C (Charging, running instrument) 0°C – 40°C (Charging, instrument is off) -10°C – 50°C (Non-charging)	
Humidity	< 95 % RH, non condensing	
IP Classification	IP54	
Pulse Echo Range		0.1 – 1200 µs
Transducer Frequency		50 kHz
Aperture Size		2x25 cm^2

3. Operation

The information provided in this manual covers the Pulse Echo application only. The Pundit PL-200PE also supports all functionality provided by the Pundit PL-200. It is necessary to purchase the BNC adapter cable (Part No. 327 01 049) for operation with standard P-wave transducers. A full listing of the standard transducers can be found on the Proceq website. The Pundit PL-200 operating manual is provided on the product DVD.

3.1 Getting Started

Battery Installation

To install the Battery (B) into the Pundit Touchscreen (A), lift the stand as shown. Insert the battery and fasten in place with the screw.

There are three status LEDs **1** (see page page 3). The middle LED is red while charging and turns to green when fully charged. The other LEDs are application specific.

NOTE! Only use the battery charger provided.

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- A complete charge requires <9h (Instrument not operating).
- Charging time is much longer if the instrument is in use.
- An optional quick charger (Part No. 327 01 053) can be used to charge a spare battery outside of the instrument. In this case it takes <4h for a complete charge.

Energy Saving

Energy saving, time to dim display and time to turn off display, may be programmed as desired under System/Power settings.

Connecting the transducer

Connect the Pulse Echo Transducer (C) to the Pundit Touchscreen (A) using the Pulse Echo Cable (D).

Buttons

Lift the protective visor.
The upper right of the screen there are three buttons **2** (see page 3).

Power On/Off – Press to power on. Press and hold to power off.

Soft Key – Switches in and out of full screen view.

Back Button – Returns to previous screen.

3.2 Main Menu

On start up the main menu is displayed. All functions may be accessed directly via the touchscreen. Return to the previous menu by pressing the back button or the return icon (arrow) at the top left of the touchscreen.

Measurement:	Application specific measurement screen.
Settings:	For application specific settings.
Explorer:	File manager functionality for reviewing measurements saved on the instrument.
System:	For system settings, eg. language, display options, power saving
Information:	For device information.
Exit:	Power Off.

3.3 Settings

Scroll up and down the screen by dragging your finger up or down the screen. The current setting is displayed on the right hand side. Tap on an item to adjust it.

Transducer

Connected Transducer

If a Pulse Echo Transducer is connected this will be recognized automatically.

Test Transducer

Each individual dry contact transducer can be tested for correct functionality.

The graphic on the right hand side of the screen indicates which transducer pair is to be tested (blue highlight). Press the Pulse Echo Contact

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Tester (E) onto the transducer pair as shown.

A successful test is indicated by the transducer pair being highlighted green.

The next pair to be tested is then highlighted blue.

Continue until each transducer pair has been tested.

If one contact pair fails the test, it may be repeated before continuing.

B-Scan

Distance between measurements

Set the spacing between measurements. For good resolution images, a spacing of 1 cm is recommended. For a quicker initial scan a coarser spacing may be used, e. g. 2.5 cm corresponding to the spacing markers on the Pulse Echo Transducer. When searching for larger objects such as delaminations or thickness variations, much coarser grid spacings may be used, e. g. 10 cm and upwards.

Units

Choose between metric and imperial units

Echo Tracking

This is particularly useful if a quick read-out of slab thickness is desired.

For complex objects containing internal defects, pipes and rebars it is recommended to perform a complete B-Scan for analysis of the object.

Filter

Filters are used to filter out unwanted noise, to make it easier to identify the correct echo.

- OFF – No filter is applied. The raw signal is displayed.
- Normal – Applies a medium band filter to the received signal.

The received signal is saved post-filtering, so it is not possible to alter the filter afterwards. Switching the filter off allows the raw data to be viewed.

Time Gain Compensation

When switched on amplifies signals that are further away from the transducer.

Envelope

When this setting is activated it uses an envelope of the A-Scan to generate the B-Scan image. This can also help to generate a clearer B-Scan image.

Color Range and Color Scheme

Color range may be automatic or manual. When set to manual, the color gain icon (9) appears on the measurement screen.

Four different color schemes may be chosen according to preference.

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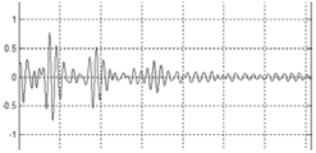
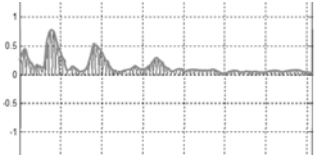
Original – Original signal is used to generate the B-Scan.



Envelope – Envelope signals is used to generate the B-Scan.



SAFT
When activated, applies a Synthetic Aperture Focusing Technique to the raw data to produce a sharper image.

SAFT uses path length and positioning information to correct the image. The quality of the final image is dependent on the spacing of the measurements.

3.4 Measurement Screen

The standard measurement screen is shown on page 3. All settings are directly accessible from the measurement screen.

Zoom

Zoom in by placing thumb and index finger together on the screen and spreading them apart. This can be used in both the horizontal and vertical directions when making a measurement.

Zoom out by placing thumb and index finger apart on the screen and pinching them together.

Pan
Pan the image from left to right by dragging.

Measuring screen controls (see page 3)

1 **Filename:** Enter the file name and press return. Saved measurements will be stored with this file name. If several measurements are made under the same file name, a suffix increments after each measurement.

2 **Measurement mode:** Select the type of measurement to be carried out (see section “3.5 Measurement Modes”).

3 The top right hand corner of the display shows the current transducer selected, current time and the battery status.

4 **Gain:** Adjust the receiver gain, from 1x up to a maximum of 10 000x.

5 **Voltage:** Adjust the transmitter voltage. For best results, it is best to begin with low transmitter voltage and a low gain setting. Then increase until a stable signal level is achieved. Signal clipping should be avoided.

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6 **Settings:** Enter the settings menu.

7 **Stop/Save (Right Button on Transducer):**

Stop the current measurement.

Save the current measurement.

Save the current series and continue the measurement.

8 **Start/Snapshot (Left Button on Transducer):**

Begin the measurement.

Save the current measurement as displayed on the screen and continue measuring.

9 Cursor Selection

Automatic triggering.

Manual triggering. Set the cursor position manually, by dragging it to the left or right. The trigger position may also be adjusted later on the saved waveform in the Explorer or in PL-Link.

Available in transmission time mode only. Allows a marker to be set on a second echo and the difference between thet two echos is displayed.

Manually adjust the colour intensity.

10 Automatic Estimation of Pulse Velocity

This setting is available in the Distance and B-Scan modes. The pulse velocity may be entered manually after having made a control measurement on an object of known thickness. Alternatively, it is possible to estimate the pulse velocity directly on surface of the test object. Tap on this button and press the transducer against the surface to make a measurement. A number of measurements can be made and an average value is calculated. Tap to apply the pulse velocity setting. Pulse velocity may be subsequently adjusted on saved files in the Explorer or in PL-Link.

NOTE! Typical shear wave pulse velocities for concrete are in the region 2000 - 2500 m/s

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3.5 Measurement Modes

Transmission time

The measured transmission time between the transmitter and receiver.

Distance

Enter the pulse velocity of the material under test or perform an “Automatic Estimation of Pulse Velocity” as described in the previous chapter.

The result is the thickness of the slab or distance to the internal object (e. g. void, delamination) that is the source of the echo.

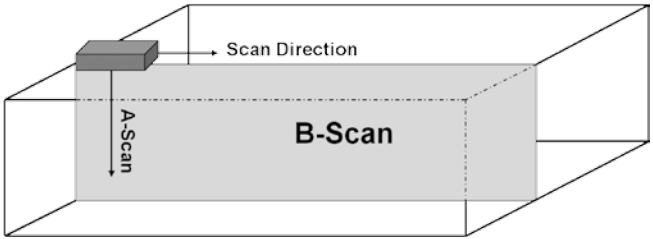
Pulse Velocity

Enter the thickness of the object under test.

The result is the transmission time and pulse velocity of the material under test.

B-Scan

Provides a cross sectional image of the test object perpendicular to the scanning surface in the plane through which the individual A-scans have been collected.



The spacing between A-Scans is entered in the “Settings” menu.

Position the transducer at the starting position.

Press the start icon to begin or the left button on the transducer.

Record the first measurement. The measurement may also be recorded by pressing the left button on the transducer.

- The LED’s on the transducer provide a visual feedback when a measurement has taken place successfully. This is accompanied by an acoustic tone on the display device. The volume of the tone may be adjusted in system settings.
- Move the transducers to the next point of the scan. Make the second measurement and continue.
- The current A-Scan is shown on the right hand side of the screen.
- The current status of the B-Scan is shown on the main part of the screen.

Press this icon or the right button on the transducer to save the current B-Scan.

Press this icon or the right button on the transducer to continue the current B-Scan.

Use this icon to delete the last measurement made.

Press the to save the current series and reset the instrument for a new series.

The green cursor (cross-hairs) may be moved to any point on the B-Scan simply by dragging. The actually cursor position is displayed on the axes. The current A-Scan selected changes with the cursor position. This is indicated by the A-Scan number at the top of the chart and also on the A-Scan display at the right side of the measurement screen. This feature is also available on saved B-Scans in the Explorer or in PL-Link.

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3.6 Measuring with Pundit PL-200PE

NOTE! Testing with Pulse Echo Technology requires in-depth knowledge of the test object and application characteristics. Proceq offers comprehensive ultrasonic training seminars imparting this knowledge as well as all functionalities and features of the Pundit instruments. Pundit PL-200PE users are recommended by Proceq to register for the Advanced Ultrasonic Tomography Applications training. Details can be found on the Proceq website.

Preparation

- Very few preparations are necessary when measuring with the Pulse Echo Transducer.
- The dry-contact transducer means that acoustic coupling is ensured without the use of any couplant.
- The contacts are sprung and can accommodate surface irregularities to a depth of 7 mm, so smoothing of the surface is also unnecessary.
- For B-Scans a test grid should be drawn out on the surface. Alternatively Proceq provide a calibrated tape (Part No. 327 010 71) that can be stuck on the surface for the test and then removed afterwards.

Calibration

The most accurate results can be obtained if the instrument is calibrated for the material under test.

- This is done by performing a pulse velocity measurement on a section of the structure of known thickness.
- Alternatively, perform the automatic estimation of pulse velocity as described in chapter 3.4.

Physical influences on the Measurement

Inhomogeneities (e. g. aggregate particles, voids) in concrete influence the propagation of an ultrasound pulse. They will scatter the signal. The effect is very large if the size of the aggregate is equal to or larger than the wavelength of the ultrasonic signal. This influence is significantly reduced when the wavelength is at least twice as large as the aggregate size. It also follows that it is very difficult to detect an anomaly if it is smaller than half the wavelength.

The Pulse Echo Transducer is a shear wave transducer with a frequency of 50 kHz.

Assuming a typical pulse velocity of 2500 m/s, the wavelength is 50 mm. This means that anomalies smaller than 25 mm will be invisible.

Effect of sample size

The geometry of the object is very important for obtaining good results.

- The maximum penetration depth depends on the quality of the concrete and also on the amount of rebars present. Typically the maximum transmission depth lies between 50 cm (19.7”) and 1m (39.4”).
- Generally, the minimum lateral dimension should be two times the thickness of the object, or the depth of the anomaly you are trying to detect. The reason for this is that if the object is too narrow, reflections from the side walls will interfere with the echo from the rear wall.

4. Explorer

From the main menu select Explorer to review saved files.

Tap on a saved file to open it.

Return to the Explorer list by pressing the back button.

To delete a file tap in the check box to the left of the file and delete it

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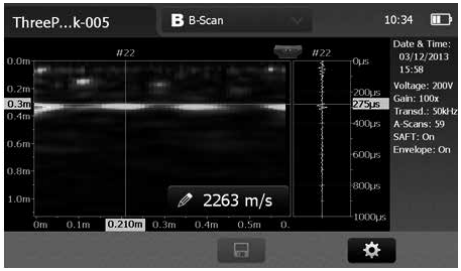
4.1 Analysis of B-Scans

Please refer to the separate booklet Pundit PL-200PE B-Scan Measurement Examples.



Explorer provides a number of tools that assist in the analysis of B-Scans.

- Drag the cross hairs to a point of interest. (e. g. back wall of sample as shown here)
- The object thickness (e. g. 0.3m) is displayed on the y-axis.
- The object position from the beginning of the scan is displayed on the x-axis.
- The current A-Scan (e. g. #22) is indicated above the B-Scan and also in the the A-Scan window.
- The current transmission time is displayed at the right hand side of the of the screen.
- The cursor position may also be adjusted by dragging on the position display boxes.
- SAFT and Envelope may be switched ON/OFF in Settings.
- Pulse velocity may be corrected.
- Spacing between measurements may be corrected.
- The color scheme may be adjusted.
- Any modifications made to the scan may be saved.
- All of these items may be adjusted later in PL-Link once the files have been downloaded to a PC.

5. Ordering Information

5.1 Units

PART NO.	DESCRIPTION
327 10 002	**Pundit Touchscreen** without transducers Consisting of: Pundit Touchscreen, BNC adapter cable, battery charger, USB cable, DVD with software, documentation, carrying strap and carrying case
327 10 001	**Pundit PL-200** Consisting of: Pundit Touchscreen, 2 Transducers 54 kHz, 2 BNC cables 1.5 m, couplant, calibration rod, BNC adapter cable, battery charger, USB cable, DVD with software, documentation, carrying strap and carrying case
327 20 001	**Pundit PL-200PE** Consisting of: Pundit Touchscreen, Pundit Pulse Echo Transducer incl. cable, contact tester, battery charger, USB cable, calibrated tape, DVD with software, documentation, carrying straps and carrying case

5.2 Transducers

PART NO.	DESCRIPTION
325 40 026S	2 Transducers 24 kHz
325 40 131S	2 Transducers 54 kHz
325 40 141S	2 Transducers 150 kHz
325 40 177S	2 Transducers 250 kHz
325 40 175S	2 Transducers 500 kHz
325 40 176	2 Exponential Transducers 54 kHz, incl. calibration rod
325 40 049	2 S-Wave Transducers 250 kHz, incl. couplant
327 40 130	Pulse Echo Transducer, incl. cable and contact tester

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5.3 Accessories

PART NO.	DESCRIPTION
327 01 043	Carrying strap complete
325 40 150	Transducer holder complete
327 01 049	BNC adapter cable for Pundit PL-200
325 40 021	Cable with BNC-plug, 1.5 m (5 ft)
325 40 022	Cable with BNC-plug, 10 m (33 ft)
710 10 031	Ultrasound couplant, 250 ml
325 40 048	Shear wave couplant, 100 g
327 01 033	Battery complete
327 01 053	Quick charger
710 10 028	Calibration rod 25 µs for Pundit PL-200
710 10 029	Calibration rod 100 µs for Pundit PL-200
327 01 070	Snap Ferrite for BNC Adapter cable*
327 01 051	Pundit Pulse Echo Cable
327 00 027	Pundit Pulse Echo Contact Tester complete
327 20 002	Pundit PL-200PE UPV Kit including BNC adapter cable, 2x cable with BNC-plug, L=1.5m (5ft), Ultrasound couplant, 250ml bottle, 2 transducers 54 kHz, calibration rod
327 01 071S	Calibrated Tape (Set of 5)

* In the case that receiving equipment within a radius of 10m suffers from interference, it is possible to order a ferrite to fit onto the BNC adapter cable. This serves to further reduce the electromagnetic radiation produced by the instrument.

6. Maintenance and Support

6.1 Maintenance

To guarantee consistent, reliable and accurate measurements, the instrument should be calibrated on a yearly basis. The customer may however, determine the service interval based on his or her own experience and usage.

6.2 Support Concept

Proceq is committed to providing a complete support service for this instrument by means of our global service and support facilities. It is recommended that the user register the product on www.proceq.com to obtain the latest on available updates.

6.3 Warranty Information

Each instrument is backed by the standard Proceq warranty and extended warranty options.

- Electronic portion of the instrument: 24 months
- Mechanical portion of the instrument: 6 months

6.4 Disposal

Disposal of electric appliances together with household waste is not permissible. In observance of European Directives 2002/96/EC, 2006/66/EC and 2012/19/EC on waste, electrical and electronic equipment and its implementation, in accordance with national law, electric tools and batteries that have reached the end of their life must be collected separately and returned to an environmentally compatible recycling facility.

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7. PL-Link Software

7.1 Starting PL-Link

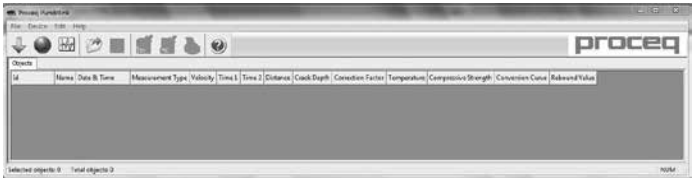
Locate the file “PL-Link Setup.exe” on your computer or on the CD and click on it. Follow the instructions on the screen.

Make sure that the “Launch USB Driver install” tick is selected.

The USB driver installs a virtual com port which is needed to communicate with the Pundit Touchscreen Unit.

Double click on the PL-Link Icon on your desktop or start the PL-Link via the start menu.

The PL-Link starts with a blank list.



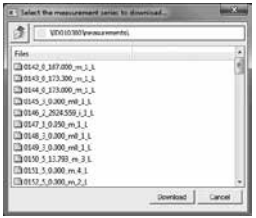
Application settings

The menu item “File – Application settings” allows the user to select the language and the date and time format to be used.

Connecting to a Pundit Touchscreen Unit

Connect the Pundit Touchscreen Unit to a USB port, then select the following icon to download data from the Pundit Touchscreen Unit.

The following window will be displayed: Select “USB” as the communication type.



Select one or more measurements and click “Download”.

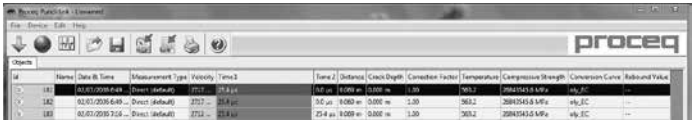
Click on “Next >”. When a Pundit Touchscreen Unit has been found its details will be displayed on screen. Click on the “Finish” button to establish the connection.

7.2 Viewing the Data

Measurement files stored on the device will be displayed in the following window:

Select one or more measurements and click “Download”.

The selected measurements on your Pundit Touchscreen Unit will be displayed on the screen:



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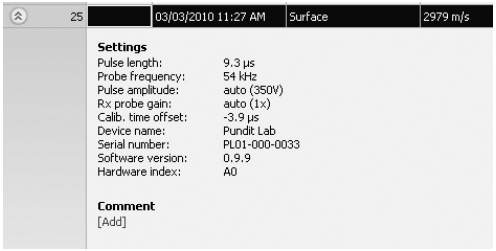
Click on the double arrow icon in the first column to see more details:



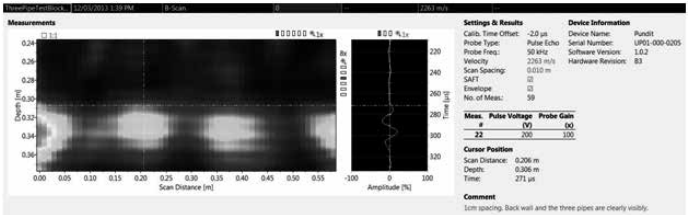
NOTE! Click on “Add” to attach a comment to the object.

7.3 Adjusting the Settings

Each of the settings that were used in the Pundit Touchscreen Unit at the time of the measurement series can be adjusted subsequently in PL-Link. This can be done either by right clicking directly on the item in the appropriate column, or by clicking on the blue setting item in the detailed view of a measurement object.

In each case a drop down selection box will appear with the choice of setting.

7.4 Analysis of B-Scans

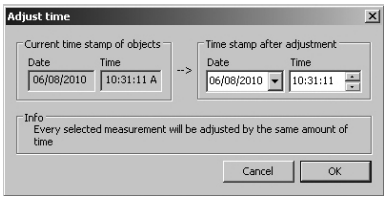


PL-Link provides a number of tools that assist in the analysis of B-Scans.

- Zoom into the B-Scan using the zoom boxes. A separate zoom box is available for the currently selected A-Scan
- Move the B-Scan in both x- and y-directions by dragging with the left mouse button.
- Move the A-Scan in the y-direction by dragging with the left mouse button.
- Drag the cross hairs to a point of interest using the right mouse button. The position is shown in the details on the right hand side.
- The current A-Scan (e. g. #22) is indicated in the table.

Adjusting the date and time

Right click in the “Date & Time” column.



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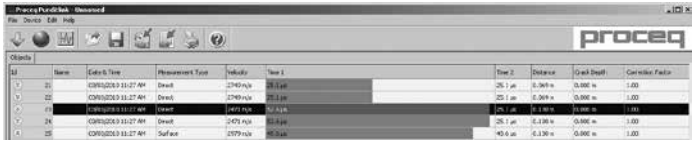
The time will be adjusted for the selected series only.

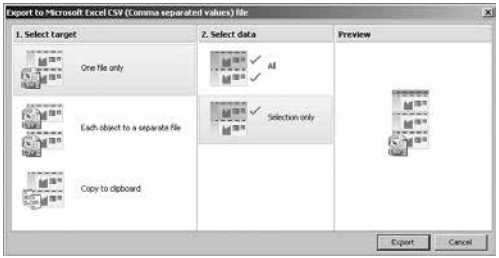
In “Data Logging” mode it is the date and time at which the measurement was made.

7.5 Exporting Data

PL-Link allows you to export selected objects or the entire project for use in third party programs. Click on the measurement object you wish to export. It will be highlighted as shown.



Click on the “Export as CSV file(s)” icon. The data for this measurement object is exported as a Microsoft Office Excel comma separated file or files. The export options may be chosen in the following window:



Click on the “Export as graphic” icon to open the following window which allows the various export options to be chosen.

In both cases, the preview window shows the effects of the current output selection.

Finish by clicking on export to select the file location, name the file and in the case of a graphical output to set the output graphic format: .png, .bmp or .jpg

7.6 Further Functions

The following menu items are available via the icons at the top of the screen:

“PQUpgrade” icon - Allows you to upgrade your firmware via the internet or from local files.

“Open project” icon – Allows you to open a previously saved .pql project.

“Save project” icon – Allows you to save the current project.

“Print” icon – Allows you to print out the project. You may select in the printer dialog, if you want to print out all of the data or selected readings only.

Clicking “Auto Scale” adjusts the zoom parameters of the waveform display to an optimum setting.

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Proceq Europe
Ringstrasse 2
CH-8603 Schwerzenbach
Phone +41-43-355 38 00
Fax +41-43-355 38 12
info-europe@proceq.com

Proceq UK Ltd.
Bedford i-lab, Priory Business Park
Stannard Way
Bedford MK44 3RZ
United Kingdom
Phone +44-12-3483-4515
info-uk@proceq.com

Proceq USA, Inc.
117 Corporation Drive
Aliquippa, PA 15001
Phone +1-724-512-0330
Fax +1-724-512-0331
info-usa@proceq.com

Proceq Asia Pte Ltd
12 New Industrial Road
#02-02A Morningstar Centre
Singapore 536202
Phone +65-6382-3966
Fax +65-6382-3307
info-asia@proceq.com

Proceq Rus LLC
Ul. Optikov 4
korp. 2, lit. A, Office 410
197374 St. Petersburg
Russia
Phone/Fax + 7 812 448 35 00
info-russia@proceq.com

Proceq Middle East
P. O. Box 8365, SAIF Zone,
Sharjah, United Arab Emirates
Phone +971-6-557-8505
Fax +971-6-557-8606
info-middleeast@proceq.com

Proceq SAO Ltd.
South American Operations
Alameda Jaú, 1905, cj 54
Jardim Paulista, São Paulo
Brasil Cep. 01420-007
Phone +55 11 3083 38 89
info-southamerica@proceq.com

Proceq China
Unit B, 19th Floor
Five Continent International Mansion, No. 807
Zhao Jia Bang Road
Shanghai 200032
Phone +86 21-63177479
Fax +86 21 63175015
info-china@proceq.com

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